

TechData Sheet

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Energy Efficient Motors

This TechData Sheet is intended to help activity personnel identify cost effective energy projects for energy efficient motors. With this guide an energy manager can identify when an energy efficient induction motor should be used.

MOTOR TYPES AND EFFICIENCIES

Motor Types

There is a wide variety of motor types. One way to categorize them is by their electrical source. DC, single phase AC, or three phase AC electrical supplies are the most common. Examples of each are:

DC	Shunt wound Series wound Compound wound
AC - 1 Phase	Repulsion Induction Repulsion-induction Series
AC - 3 Phase	Induction (Asynchronous) Synchronous

Another way to categorize motors is by their application or load. Loads can be classified into solids, liquids, and gasses (e.g., elevator systems, water pumps, and HVAC fan systems, respectively) and define such specifications as horsepower, speed, and torque design characteristics. Speed classifications are:

- Constant Speed
- · Adjustable Speed
- Multi Speed
- · Varying Speed
- · Adjustable Varying Speed

The load connection configuration defines specifications such as vertical or horizontal shaft position, pulley or direct drive, and speed. The environment defines motor specifications through ambient conditions and human factors. Ambient conditions such as humidity and ventilation define the needed enclosure type and cooling methodology. Human factors such as accidents, failures, or errors define specifications such as splash proof protection. Common open or totally enclosed enclosures are:

Open	Totally Enclosed
Drip proof Splash proof Guarded Semi-guarded Drip proof guarded Externally ventilated Pipe ventilated Weather protected, types I and II Encapsulated windings Sealed windings	Non-ventilated Fan cooled Fan cooled guarded Explosion proof Dust ignition proof Pipe ventilated Water cooled Water air cooled Air-to-air cooled

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Motor Efficiencies

The standards for energy efficient motors apply only to induction motors. This data sheet addresses only induction motor applications which are the most common. Motor efficiency is defined, in its simplest terms, as delivered shaft power divided by electrical input power. Not all of the electrical input is converted to mechanical power. The associated losses determine the efficiency of a motor. Motor losses are attributable to load independent and or load dependent causes. Typical losses and their usual range as a percent of total loss are given below:

Category	Loss (%)	Contributing Factors
Core (Iron)	15-25	Type and design of core material
Friction/Windage	5-15	Bearings and fan
Stator I ² R	25-40	Stator conductor impedance
Rotor I ² R	15-25	Rotor conductor impedance
Stray Load	10-20	Manufacturing and design

Motor Loss Categories

The National Electrical Manufacturers Association (NEMA) established standards for motor efficiency. Following NEMA standard for induction motors, efficient motor designers and manufacturers have improved overall motor performance with respect to nominal efficiency and power factor. Nominal motor efficiencies are defined by the American National Standards Institute (ANSI) testing standards C50.20.

WHEN TO BUY ENERGY EFFICIENT MOTORS

Energy efficient motors should be considered in the following circumstances:

CASE I - When a new motor is being purchased

CASE II - When considering rewinding a failed motor

CASE III - When an existing motor is operating inefficiently

The potential electricity saved is dependent on the horsepower (hp), speed, and percent load of the new and existing motors as defined in Equation 1.

$$E_s = 0.746 \frac{kW}{HP} \cdot HP \cdot (\eta_{std}^{-1} - \eta_{high}^{-1})$$
 (1)

where:

 E_s = energy saved

HP = horse power

 η_{sd} = efficiency of standard motor

 η_{high} = efficiency of standard motor

The potential dollars saved can be calculated by multiplying the energy saved in kW by the cost per kWh by hours of operation per year.

$$D_s = (E_s) (C_F) (H_{op})$$
 (2)

where:

 D_s = dollars saved

 E_s^s = energy saved

 $C_E = cost of electricity in $/kWh$

 H_{on} = hours of motor operation per year

For CASE I the simple payback can be calculated by subtracting the cost of the existing standard motor from the cost of the efficient motor and dividing the difference by the dollars saved per year. For CASE II the simple payback can be calculated by subtracting the cost of rewinding the existing standard motor from the cost of the efficient motor including all associated costs and dividing the difference by the dollars saved per year. calculated from Equation (2). For CASE III the simple payback can be calculated by subtracting the cost of operating the existing standard motor inefficiently from the cost of the efficient motor including all associated costs and dividing the difference by the dollars saved per year. Equation (3) summarizes the payback calculation.

$$P = \frac{C_{high} - C_{std}}{D}$$
 (3)

where:

P = simple payback in years $C_{high} = efficient motor costs$ $C_{std} = standard motor costs$ $D_{s} = dollars saved per year$

An efficient motor typically has a higher starting current than a standard motor and the potential effects on the motor power circuits should be analyzed. An efficient motor typically operates at a faster speed than a standard motor. Particular consideration should be given to the actual operating rpm specified. In some cases although the efficient motor is operating more efficiently the faster speed requires more energy to operate and could result in a net increase in energy expense, eliminating the cost effectiveness. For CASE I applications, speed sensitive loads should be considered carefully.

For CASE II applications, special high efficiency rewinding can yield a higher than manufactured efficiency for a standard motor, but will still be less than the NEMA 12-6C efficiency.

For CASE III applications, motor system consultants usually only consider motors with operating hours in excess of 2,000 hours per year. Applications such as emergency fire water pumps and back-up motors are only operated a few hours a year.

To further define CASE III, Tables 1 and 2 show the minimum operating hours required to yield simple paybacks between 2 and 10 years. Values are calculated at electrical rates between \$0.03/kWh and \$0.10/kWh. Table 1 is for Open Drip Proof (ODP) enclosure motors and Table 2 is for Totally Enclosed Fan Cooled (TEFC) and Explosion Proof enclosure motors. The tables are provided so that the user can quickly identify potential motor projects and eliminate from consideration most of the motors with a long or no payback. The assumptions include:

• The motors are at 75% of rated load since motor efficiency is usually the highest at 75% of rated output.

- The efficient motor is at nominal efficiency defined by NEMA 12-6C.
- The standard motor is at the average of the nominal efficiencies of currently manufactured motors that do not meet NEMA 12-6C.
- The user would choose an ODP, TEFC, or explosion proof enclosure.
- The demand charge and the incremental speed increase can be ignored.

To use the payback tables, locate the horsepower rating and speed rating in the appropriate columns. Identify the columns that are within your approximate energy charge in \$/kWh. The columns labeled with 2, 3, 4, or 5 indicate the simple payback years. The minimum annual hours of operation are included within the matrix. In the tables, spaces marked with a dashed line (---) indicate that even constant operation, 8,760 hours per year, would not yield a payback in the number of years listed. For example replacing an existing standard motor with an efficient motor that is rated a 40 hp and 1,800 rpm operating in a facility with an approximate energy charge of \$0.08/kWh would require at least 3,598 operating hours per year to vield a simple payback of 4 years.

Both tables show an increase in efficiency of approximately 5%. All tables in this article were generated using the Washington State Energy Office's Motor Master software. In general, incentives offered by motor distributors and/or electric utilities will yield a shorter payback. For example, a 10% discount on motor price can reduce the simple payback period by 0.2 to 0.3 years. Some typical rebates available from utilities around the country are:

Horsepower at 1,800 rpm	Rebate (\$)
10	140
20	260
40	430
50	500
75	730
100	920
200	1,300

Table 1. Hours of operation at various electrical rates and paybacks for open drip proof enclosure motors.

Horse						03/kW								At \$0.	04/kW	h			
Powe		1 -				ick in Y					1			Payba	ick in Y	ears			
20	900	2	3	4	5	6	7	8	9	10	2	3	4	5	6	7	8	9	10
20	1800		-									1—			-		-		
	3600				-	8192					_			7380	6150	5271	4613	4100	369
40	900				1 2400	7333						-	8250	6600	5500	4714	4125	3667	
40	1800		=	_	8188					1	_							8036	
	3600				7690							_	7210	5768	4807	4120	3605		
50	900				7980	6650	5700	4988	4433	3990			7480	5984	4987	4274	3740	3324	299
- 30	1800				7000			-		_									850
	3600				7960			_	4422				7470	5976	4980	4269	3735	3320	
75	900				7560				4200				7080	5664	4720	4046	3540	3147	28
/3	1800			==	8200	6833	5857		4558				-						771
	3600				8430	7025	6021		4683	4215			7900	6320	5267	4514	3950	3511	316
100	900				8200	6833	5857	5125	4558	4100			7690	6152	5127	4394	3845	3418	30
100	1800																		747
	3600		=		8040		5743	5025	4467	4020			7530	6024	5020	4303	3765	3347	301
200						7527	6451	5645	5018	4516			8470	6776	5647	4840	4235	3764	338
200	900		_!-														8325	7400	
	1800					7935	6801	5951	5290	4781				7140	5950	5100	4463	3967	357
200	3600						7849	6868	6104	5494				8240	6867	5886	5150	4578	
300	1800						8539	7471	6641	5977					7472	6404	5604	4981	448
	3600					7750	6643	5813	5167	4650			8718	6974	5812	4981	4359	3874	348
400	900			_			8141	7124	6332	5699				8550	7125	6107	5344		
	1800							8659	7697	6927				0000	8857	7420	6493	4750	427
	3600			_		8083	6929	6063	5389	4850				72701	6058	5193	4544	4039	519
	- 1				At \$0.05	5/kWh								At \$0.0		3133	4544	4039	363
torse					Paybac	k in Ye	ars			- 1					k in Ye				
ower	RPM	2 ;	3	4	5	6	7	8	9	10	2	3	4	5	6	7	8	9	10
20	900		_:-					82911	7370	6633						· ·	69091	61411	
	1800			7375		4917	4214	3688	3278	2950		8197	61481	49181	4098	3513	3074	27321	245
	3600		- (5600	5280	4400	3771	3300	2933	2840		7340		44041	3670	3146	2753	2447	220
40	900		_!_				8269	7235	6431	5788 -					8037	6889	6028	5358	
	1800	76		57681		3845	32961	2884	2563	2307		6413	4810!	38481	3207			2138	1924
	3600	: 79	70 5	978	4782	3985	3416	2989	2657	2391 -		6650		3990	3325			2217	1999
50	900							8506	7561	6805						8103			
	1800	 79		9681	4774	3978	3410	2984	2652	2387		6640	4980	39841	3320				5672
	3600	75	43 5	658	4526	3772	3233	2829	2514	2263 -		63001							1992
75	900							7715	6858	6172 -			*****	-	8573				1890
- 1	1800	843		3281	5062	4218	3616	3164	2812	2531 -		7017	52631		3508		6430		5144
	3600	819	7 6	148	4918	4098	3513	3074	2732	2459 -									2105
100	900						8547		5648	5983 -			31201						2051
L	1800	804	101 6	030	4824	1020				2412 -		6703	5028 4						4983
	3600		- 6	7701	5416					2708 -									2011
200	900		- -							5327 -		1333	5650 4						2260
	1800		- 7	140	5712 4					3327 2856		7022	5055						4438
	3600		- 8							2050 - 3296 -									2380
300	1800		-1-																2744
- 1	3600		- 69							3584 – 2790 –	_								2984
	900																	2582 2	2324
100						10014	10001 4	2/0/3	800	3420 -			7115 5	692 4	1743	4066 3	35581 3	3162: 2	2846
100	1800				7		AAA! E	E30 5											2040
			72	268: 5		518 6			012	4511 — 2907 —	==		8655 6	924 5	770:	4946 4			3462

Table 1 (Cont). Hours of operation at various electrical rates and paybacks for open drip proof enclosure motors.

		_			A+ \$0 /	7/kW/													
Horse		1				ck in Y					At \$0.08/kWh Payback in Years								
Power	RPM	2	3	4	5		ears 7	_	_		1 -	_		-					
20	900					6 7897		8	9	10	2	3	4	5	6	7	8	9	10
20	1800		7030	5273	4218	3515	6769		5264					8288					
l	3600		6277	4708	3766	3138	3013 2690		2343	2109		6137		3682	3068		2301	2046	1841
40	900		0211	4708					2092	-		5490	4118	3294	2745	2353	2059	1830	1647
40	1800		5490	4118	8268 3294	6890		5168	4593					7228	6023	5163	4518	4016	3614
1	3600			4270	3416	2745		2059	1830	1847	7195	4797		2878	2398	2056	1799	1599	1439
50	900		3093	42/0	3416	2847	2440	2135	1898	1708	7475	4983	3738	2990	2492		1869	1661	1495
30	1800		5690	4268	244.4	8102		6076	5401	4861				8498	7082		5311	4721	4249
i	3600	8095		4048	3414	2845		2134	1897	1707	7465	4977	3733		2488	2133	1866	1659	1493
75	900	0033	5397	4040	3238	2698	2313	2024	1799	1619	7100	4733	3550	2840	2367	2029	1775	1578	1420
/5			0007	4500		7352	6301	5514	4901	4411				7708	6423	5506	4818	4282	3854
1	1800 3600		6027	4520	36161	3013		2260	2009	1808		5263		3158	2632	2256	1974	1754	1579
100			5857	4393	3514	2928	2510	2196	1952	1757	7875	5117	3838	3070	2558	2193	1919	1706	1535
100	900				8540	7117	6100	5338	4744	4270				7480	6233	5343	4675	4156	3740
	1800	8620	5747	4310	3448	2873	2463	2155	1916	1724	7535	5023	3768	3014	2512	2153	1884	1674	1507
	3600		6453	4840	3872	3227	2766	2420	2151	1936	8480	5653	4240	3392	2827	2423	2120	1884	1696
200	900				7610	6342	5436	4756	4228	3805			83181	6654	5545	4753	4159	3697	3327
	1800		6797	5098	40781	3398	2913	2549	2266	2039		5957	4468	3574	2978	25531	2234	1986	1787
	3600		7853	5890	4712	3927	3366	2945	2618	2356		6867	5150	4120	3433	2943	2575	22891	2060
300	1800		8530	6398	51181	4265	3656	3199	2843	2559		7467	5600	4480	3733	3200	2800	2489	2240
	3600		6650	4988	3990	3325	2850	2494	2217	1995		5817	4363	3490	2908	2493	2181	19391	1745
400	900		8140	6105	4884	4070	3489	3053	2713	2442		7123	5343	4274	3562	3053	2671	2374	2137
	1800			7425	5940	4950	4243	3713	3300	2970		86471	6485	5188	4323	3706	3243	2882	2594
	3600		6923	5193	4154	3462	2967	2596	2308	2077		60571	45431	3634	3028	2596	2271	2019	
					44 60 0		_												
					At \$0.09	9/KWh								At \$0.1	0/kWh				
Horse					At \$0.05 Paybac		ars									ars			
Power	RPM	2	3		Paybac 5	k in Ye 6	7	8	9	10	2	3	4	Paybac 5	0/kWh kin Ye 6	ars 7	8	9	10
	900			4	Paybac 5 7368	k in Ye 6 6140	7 5263	4605	4093	3684			4 82881	5 6630	k in Ye 6 5525	7 4736	8 4144		10 3315
Power	900 1800	8180	5453	4090	73681 32721	6 6140 2727	7 5263 2337	4605 2045	4093 1818	3684 1636	7380	4920	4 82881 36901	5 6630 2952	6 5525 2460	7			
Power 20	900 1800 3600	8180		4 4090 3668	7368 3272 2934	6 6140 2727 2445	7 5263 2337 2096	4605 2045 1834	4093 1818 1630	3684 1636 1467			4 82881 36901 33001	5 66301 29521 2840	k in Ye 6 5525	7 4736	4144	3683	3315
Power	900 1800 3600 900	8180 7335	5453 4890	4090 3668 8038	7368 3272 2934 6430	6 6140 2727 2445 5358	7 5263 2337 2096 4593	4605 2045 1834 4019	4093 1818 1630 3572	3684 1636 1467 3215	7380 6600	4920 4400	4 82881 36901	5 6630 2952	6 5525 2460	7 4736 2109	4144 1845	3683 1640	3315 1476
Power 20	900 1800 3600 900 1800	8180 7335 6400	5453 4890 4267	4090 3668 8038 3200	7368 3272 2934 6430 2560	6 6140 2727 2445 5358 2133 1	7 5263 2337 2096 4593 1829	4605 2045 1834 4019 1600	4093 1818 1630 3572 1422	3684 1636 1467 3215 1280	7380 6600 5770	4920	4 82881 36901 33001	5 66301 29521 2840	6 5525 2460 2200	7 4736 2109 1886	4144 1845 1650	3683 1640 1467	3315 1476 1320
20 40	900 1800 3600 900 1800 3600	8180 7335	5453 4890 4267	4090 3668 8038	7368 3272 2934 6430 2560 2654	6 140 2727 2445 5358 2133 2212	7 5263 2337 2096 4593 1829 1896	4605 2045 1834 4019 1600 1659	4093 1818 1630 3572 1422 1474	3684 1636 1467 3215 1280 1327	7380 6600	4920 4400	4 82881 36901 33001 72401	5 6630 2952 2640 5792	5525 2460 2200 4827	7 4736 2109 1886 4137	4144 1845 1650 3620	3683 1640 1467 3218	3315 1476 1320 2896
Power 20	900 1800 3600 900 1800 3600	8180 7335 6400 6635	5453 4890 4267 4423	4090 3668 8038 3200 3318	7368 3272 2934 6430 2560 2654 7560	k in Ye 6 6140 2727 2445 5358 2133 2212 6300	7 5263 2337 2096 4593 1829 1896 5400	4605 2045 1834 4019 1600 1659 4725	4093 1818 1630 3572 1422 1474 4200	3684 1636 1467 3215 1280	7380 6600 5770	4920 4400 3847	4 82881 36901 33001 72401 28851	9840 5 6630 2952 2840 5792 2308	5525 2460 2200 4827 1923	7 4736 2109 1886 4137 1649	4144 1845 1650 3620 1443	3683 1640 1467 3218 1282	3315 1476 1320 2896 1154
20 40	900 1800 3600 900 1800 3600 900 1800	8180 7335 6400 6635 6635	5453 4890 4267 4423	4090 3668 8038 3200 3318	Paybac 5 73681 32721 29341 64301 25601 26541 75601 26541	k in Ye 6 6140 2727 2445 5358 2133 2212 6300 2212	7 5263 2337 2096 4593 1829 1896 5400 1896	4605 2045 1834 4019 1600 1659 4725 1659	4093 1818 1630 3572 1422 1474 4200 1474	3684 1636 1467 3215 1280 1327 3780 1327	7380 6600 5770 5980	4920 4400 3847	4 82881 36901 33001 72401 28851 29901	Paybac 5 6630 2952 2640 5792 2308 2392	5525 2460 2200 4827 1923	7 47361 21091 18861 41371 16491 17091	4144 1845 1650 3620 1443 1495	3683 1640 1467 3218 1282 1329	3315 1476 1320 2896 1154 1196
20 40 50	900 1800 3600 900 1800 3600 900 1800 3600	8180 7335 6400 6635	5453 4890 4267 4423	4090 3668 8038 3200 3318 3318 3150	Paybac 5 7368 3272 2934 6430 2560 2654 7560 2654 2520	k in Ye 6 6140 2727 2445 5358 2133 2212 6300 2212 2100	7 5263 2337 2096 4593 1829 1896 5400 1896 1800	4605 2045 1834 4019 1600 1659 4725 1659 1575	4093 1818 1630 3572 1422 1474 4200 1474 1400	3684 1636 1467 3215 1280 1327 3780 1327 1260	7380 6600 5770 5980	4920 4400 3847 3987	4 82881 36901 33001 72401 28851 29901 85001	Paybac 5 6630 2952 2840 5792 2308 2392 6800	5525 2460 2200 4827 1923 1993 5667	7 4736 2109 1886 4137 1649 1709 4857	4144 1845 1650 3620 1443 1495 4250	3683 1640 1467 3218 1282 1329 3778	3315 1476 1320 2896 1154 1196 3400
20 40	900 1800 3600 900 1800 3600 900 1800 3600 900	8180 7335 6400 6635 6635	5453 4890 4267 4423 4423 4200	4090 3668 8038 3200 3318 3318 3150 8580	Paybac 5 7368 3272 2934 6430 2560 2654 7560 2654 2520 6864	k in Ye 6 6140 2727 2445 5358 2133 2212 6300 2212 2100 5720	7 52631 2337 2096 4593 1829 1896 5400 1896 1800 4903	4605 2045 1834 4019 1600 1659 4725 1659 1575 4290	4093 1818 1630 3572 1422 1474 4200 1474 1400 3813	3684 1636 1467 3215 1280 1327 3780 1327 1260 3432	7380 6600 5770 5980	4920 4400 3847 3987	4 82881 36901 33001 72401 28851 29901 85001 29801	Paybac 5 66301 29521 28401 57921 23081 23921 68001 23841	5525 2460 2200 4827 1923 1993 5667 1987	7 4736 2109 1886 4137 1649 1709 4857 1703	4144 1845 1650 3620 1443 1495 4250 1490	3683 1640 1467 3218 1282 1329 3778 1324	3315 1476 1320 2896 1154 1196 3400 1192
20 40 50	900 1800 3600 900 1800 3600 900 1800 3600 900 1800	8180 7335 6400 6635 4635 47020 4	5453 4890 4267 4423 4423 4200	4090 3668 8038 3200 3318 3318 3150 8580 3510	Paybac 5 7368 3272 2934 6430 2560 2654 7560 2654 2520 6864 2808	k in Ye 6 6140 2727 2445 5358 2133 2212 6300 2212 2100 5720 2340	7 52631 2337 2096 4593 1829 1896 5400 1896 1800 4903 2006	4605 2045 1834 4019 1600 1659 4725 1659 1575 4290 1755	4093 1818 1630 3572 1422 1474 4200 1474 1400 3813 1560	3684 1636 1467 3215 1280 1327 3780 1327 1260	7380 6600 5770 5980	4920 4400 3847 3987	4 82881 36901 33001 72401 28851 29901 85001 29801 28301	Paybac 5 66301 29521 28401 57921 23081 23921 68001 23841 22641	5525 2460 2200 4827 1923 1993 5667 1987 1887	7 4736 2109 1886 4137 1649 1709 4857 1703 1617	4144 1845 1650 3620 1443 1495 4250 1490 1415	3683 1640 1467 3218 1282 1329 3778 1324 1258	3315 1476 1320 2896 1154 1196 3400 1192 1132
20 40 50 75	900 1800 3600 900 1800 3600 900 1800 3600 900 1800 3600	8180 7335 6400 6635 6635	5453 4890 4267 4423 4423 4200	4090 3668 8038 3200 3318 3318 3150 8580 3510 3418	Paybac 5 7368 3272 2934 6430 2560 2654 7560 2654 2520 6864 2808 2734	k in Ye 6 6140 2727 2445 5358 2133 2212 6300 2212 2100 5720 2340 2278	7 52631 2337 2096 4593 1829 1896 5400 1896 1800 4903	4605 2045 1834 4019 1600 1659 4725 1659 1575 4290	4093 1818 1630 3572 1422 1474 4200 1474 1400 3813	3684 1636 1467 3215 1280 1327 3780 1327 1260 3432	7380 6600 5770 5980 5960 5660	49201 44001 3847 3987 3973 3973	4 82881 36901 33001 72401 28851 29901 85001 29801 28301 77101	Paybac 5 66301 29521 28401 57921 23081 23921 68001 23841 22641 61681	5525 2460 2200 4827 1923 1993 5667 1987 1887 5140	7 4736) 2109) 1886) 4137) 1649) 1709) 4857) 1703) 1617) 4406)	4144 1845 1650 3620 1443 1495 4250 1415 3855	3683 1640 1467 3218 1282 1329 3778 1324 1258 3427	3315 1476 1320 2896 1154 1196 3400 1192 1132 3084
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90wer 20 40 50 75 100 100 100 100 100 100 100 100 100 10	900 1800 3600 900 1800 3600 900 1800 900 1800 900 1800 900 1800 3600	8180 7335 6400 6635 46635 46635 46635 46635 466855 466855 46685 46685 46685 46685 46685 46685 466855 466	5453 4890 4267 4423 4200 4680 4557	4090 3668 8038 3200 3318 3318 3150 8580 3510 3418 8300 3348 3768	Paybac 5 7368 3272 2934 6430 2560 2654 7560 2654 2520 6864 2734 6640 2678 3014	k in Ye 6 6 6 140 2727 2445 5358 2133 2212 2100 5720 2340 2278 5533 2232 1	7 5263 2337 2096 4593 1829 1896 5400 1896 1800 4903 2006 1953 4743	4605 2045 1834 4019 1600 1659 4725 1659 1575 4290 1755 1709 4150	4093 1818 1630 3572 1422 1474 4200 1474 1400 3813 1560 1519 3689	3684 1636 1467 3215 1280 1327 3780 1327 1260 3432 1404 1367 3320	7380 6600 5770 5980 5960 5660 6320 6150	4920 4400 3847 3987 3973 3973 4213 4100 4020	4 82881 36901 33001 72401 28851 29901 85001 29801 28301 77101 31601 30751 74801 30151	Paybac 5 6630 2952 2840 5792 2308 2392 6800 2384 2264 6168 2528 2460 5984 2412	5525 2460 2200 4827 1923 1993 5667 1887 5140 2107 2050 4987	7 4736 2109 1886 4137 1649 1709 4857 1703 1617 4406 1806 1757 4274	4144 1845 1650 3620 1443 1495 4250 1490 1415 3855 1580 1538	3683 1640 1467 3218 1282 1329 3778 1324 1258 3427 1404 1367 3324 1340	3315 1476 1320 2896 1154 1196 3400 1192 1132 3084 1264 1230
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90wer 20 40 50 75 100 100 100 100 100 100 100 100 100 10	900 1800 3600 900 1800 3600 900 1800 3600 900 1800 3600 900 1800 3600 1800 3600 1800	8180 7335 6400 6635 4635 46835 46835 46695 47535 57940 56695 47535 47535 4755 4755 4755 4755 4755	5453 4890 4267 4423 4423 4200 4680 4557 4683 5023 5023 5023 5023 5023	4090 3668 3200 3318 3150 8580 3510 3418 8300 3348 7400 3970 4578 4975	Paybac 5 73681 32721 2934 64301 25601 26541 75601 26541 25201 68641 28081 27341 66401 26781 31761 36621 39801	6 6140 2727 2445 5358 2133 2212 2100 5720 2278 5533 2278 2512 2512 2512 2512 2512 2512 2512 251	7 5263 2337 2096 4593 1829 1896 1896 1800 4903 2006 1953 4743 1913 4729 2269 2269	4605 2045 1834 4019 1600 1659 4725 1659 1575 4290 1755 1709 4150 1674 1884 3700 1985 2289	4093 1818 1630 3572 1422 1474 4200 1474 1400 3813 1560 1519 3689 1488 1674 3289 1764	3684 1636 1467 3215 1280 1327 3780 1327 1260 3432 1404 1367 3320 1339 1507 2960 1588	7380 6600 5770 5980 5960 5660 6320 6150 6030 6780 7140 8240	4920 4400 3847 3987 3973 3773 4213 4100 4020 4520 4760	4 82881 36901 33001 72401 28851 29801 85001 29801 28301 77101 30751 74801 30751 33901 66601 35701 41201	Paybac 5 6630 2952 2840 5792 2308 2308 2392 6800 2384 2264 6168 2528 2412 2412 2712 5328 2356 3296	k in Ye 6 5525 2460 2200 4827 1923 1993 1987 1887 5140 2050 4987 2010 2260 4440 2380	7 47361 21091 18861 41371 16491 17091 48571 17031 16171 44061 18061 17571 42741 17231 19371 38061 20401 23541	4144 1845 1650 3620 1443 1495 4250 1490 1415 3855 1580 1538 3740 1508 1695 3330 1785	3683: 1640: 1467: 3218: 1282: 1329: 3778: 1324: 1258: 3427: 1404: 1367: 3324: 1340: 1507: 2960: 1587: 1831:	3315 1476 1320 2896 1154 1196 3400 1192 1132 3084 1264 1230 2992 1206 1356 2664 1428 1648
75 100 200 300	900 1800 3600 900 1800 3600 900 1800 3600 900 1800 3600 900 1800 3600 900 1800 3600 900 1800 3600	8180 7335 6400 6635 4635 46835 47535 5695 4755	5453 4890 4267 4423 4423 4200 4680 4557 4683 5023 5023 5023 5023 5023	4090 3668 8038 3200 3318 3150 8580 3510 3418 3768 7400 3768 4975 3873	Paybac 5 73681 32721 2934 64301 25601 26541 75601 26541 25201 68641 28781 30141 59201 31761 36621 39801	k in Yee 6 61401 2727/ 2445 5358 2133 2133 2212 21001 57201 2278 55531 22232 49331 2647 3052	7 5263 2337 2096 4593 1829 1896 5400 1896 1800 4903 2006 1953 4743 1913 2153 4229 2269 2616 2843	4605 2045 1834 4019 1600 1659 4725 1659 1575 4290 1755 1709 1674 1884 3700 1985 2289 2488	4093 1818 1630 3572 1422 1474 4200 1474 1400 3813 1560 1519 1488 1674 3289 1764 2034	3684 1636 1467 3215 1280 1327 3780 1327 1260 3432 1404 1367 3320 1339 1507 2960 1588 1831	7380 6600 5770 5980 5980 5960 6320 6150 6030 6780 7140 8240	49201 44001 3847 3987 3973 3973 4213 4100 4020 4520 4760 5493 5977	4 82881 36901 33001 72401 28851 29901 85001 29801 28301 77101 30751 74801 30751 74801 33901 666601 35701 41201 44831	Paybac 5 6630 2952 2840 5792 2308 2392 6800 2384 2264 6168 2528 2460 5984 2412 2712 5328 3296 3296 3586	k in Ye 6 5525 2460 2200 4827 1923 1993 1987 1887 5140 2050 4987 2050 4440 2260 4440 2380 2747	7 47361 21091 18861 41371 16491 17091 17091 18061 17571 42741 17231 19371 38061 20401 23541	4144 1845 1650 3620 1443 1495 4250 1490 1415 3855 1580 1538 1538 1695 3330 1785 2060	3683: 1640: 1467: 3218: 1282: 1329: 3778: 1324: 1258: 3427: 1404: 1367: 3324: 1340: 1507: 2960: 1587: 1831: 1992:	3315 1476 1320 2896 1154 1196 3400 1192 1132 3084 1264 1230 2992 1206 1356 2664 1428 1648 1793
75 100 200 1	900 1800 3600 900 1800 3600 900 1800 3600 900 1800 3600 900 1800 3600 1800 3600 1800	8180 7335 6400 6635 6635 6635 6635 6695 66	5453 4890 4267 4423 4423 4200 4680 4557 4683 5023 5023 5023 5023 5023	4090 3668 8038 3200 3318 3150 8580 3510 3418 3768 7400 3970 4578 4975 3873	Paybac 5 7368 3272 2934 64300 2560 2654 7560 2654 2520 68640 25734 6840 2678 3014 5920 3176 3176 3662 3980 3098 30	k in Yee 6 61401 27277 24451 24451 22121 23301 22121 21001 22721 23401 22781 55533 222321 25121 49331 30521 33317; 225821	7 5263 2337 2096 4593 1829 1896 5400 1896 1800 4903 2006 1953 4743 1913 2153 4229 2269 2616 2843 2213	4605 2045 1834 4019 1600 1659 4725 1659 1755 4290 1755 1709 4150 1674 1884 3700 1985 2289 2488 1936	4093 1818 1630 3572 1422 1474 4200 1474 1400 3813 1560 1519 1488 1674 3289 1764 2034 2211	3684 1636 1467 3215 1280 1327 3780 1327 1260 3432 1404 1367 3320 1507 2960 1588 1831 1990	7380 6600 5770 5980 5980 5960 6320 6150 6030 6780 7140 8240	49201 44001 3847 3987 3973 3973 3773 4213 41001 40201 45201 47601 54931 5977 46501	4 82881 36901 33001 72401 28851 29901 85001 29801 29801 28301 77101 30751 74801 30151 33901 66601 35701 41201 44831 3488	Paybac 5 6630 2952 2840 5792 2308 2392 6800 2384 2264 6168 2412 2712 5328 2452 2712 5328 2856 3586 2790	k in Ye 6 5525 2460 2200 4827 1923 1993 5667 1887 2107 2050 4987 2010 2260 4440 2380 2380 2385	7 4736 2109 1886 4137 1649 1709 4857 1703 1617 4406 1757 4274 1723 1937 3806 2040 2354 2993	4144 1845 1650 3620 1443 1495 4250 1415 3855 1580 1538 3740 1508 1695 33330 1785 2060 2241 1744	3683: 1640: 1467: 3218: 1282: 1329: 3778: 1324: 1258: 3427: 1404: 1367: 3324: 1507: 2960: 1587: 1831: 1992: 1550:	3315 1476 1320 2896 1154 1196 3400 1192 1132 3084 1230 1236 1236 1236 1428 1428 1428 1648 1793 1395
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Table 2. Hours of operation at various electrical rates and paybacks for totally enclosed, fan cooled, and explosion proof enclosure motors.

		At \$0.03/kWh											At \$0.04/kWh									
Horse			_		Payback in Years						1			Payba	ayback in Years							
Power	_		3	4	5	6	7	8	9	10	2	3	4	5	6	7	8	9	10			
'	0 1800	_		-	_					6368		-			7957	6820	5968	5304				
<u> </u>	3600			-!		-				5300		-		7936	6613	5669	4960	4409	3968			
2	0 1800			-						6105		_			7637	6546	5728	5091				
	3600					797	2 6833	5979	5314	4783	-	_		7166	5972	5119	4479	3981	3583			
4	0 1800		1=		-	_		7500		,		_			7503	6431	5628	5002				
<u> </u>	3600			-		740		5553					8323	6658	5548	4756	4161	3699	3329			
) 51	1800	1	-	-	$\downarrow =$					6082		-			7578	6496	5684	5052				
-	3600	_	1-		8672	722	6194	5420	4818	4336	_	_	8148	65181	5432	4656	4074	3621	3259			
7:											-	-										
	1800								7894	7105		_				7609	6658	5918	5326			
	3600	1=			-!		-	7840	6989	6272	_				7840	6720	5880	5227	4704			
100	1800			-1		_	-	8333	7407	6666	_	-			8322	7133	6241	5548	4993			
	3600			-	!			-	8439	7595	_	_				8147	7129	6337	5703			
200			-i 		-			_		_	_		-				7 125	7903				
	1800		·		_		-	_										8196	7376			
	3600			-	-				8692	7823			-			8386	7338	6522	5870			
300					-			_	_							0000	7556	0322	3070			
	1800				_	_		8683	7718	6946					8687	7446	6515	5791	5212			
	3600	_	-	-	_			8103	7202	6482					8103	6946	6078	5402	4862			
400	900		-				_								0103	0340	00/0	8594				
	1800		-					8410	7476	6728					8410	7209	6308	5607	7735			
	3600		-	-					8410					=	04101	8109		6307	5046 5676			
					At \$0.	05/kWI	1						-	At \$0.0	S/AA/b	0108	70851	6307	30/6			
Horse					Payba	ck in Y	ears							Paybac		-						
	RPM	2	3	4	5	6	7	8	9	10	2	3	4	5	6	7	8	9	10			
10	1800				7638	6365	5456	4774	4243	3819			7973	63781	53151	4556	3986		3189			
	3600			7950		5300	4543	3975	3533	3180			6615		4410	3780	3308	2940	2646			
20					7324	6103	5231	4578	4069	3662		_	7623		5082	4356	3811	3388	3049			
	3600			7160	5728	4773	4091	3580	3182	2864		7970	5978		3985		2989	2657	2391			
40			8670			4335	3716	3251	2890	2601			7490	59921	49931			3329	2996			
	3600		8143	6108	4886	4072	34901	3054	2714	2443		7417	5563		3708	3179		2472	2225			
50					7272	6060	51941	4545	4040	3638			7578		5052	4330		3368	3031			
	3600			6658	5326	4438	3804	3329	2959	2663		7243							2173			
75	900									8261						3.04			6886			
	1800				8532	7110	6094	5333	4740	4266				71141	5928	5081			3557			
	3600				7516	6263	53691						7840						3136			
100	1800				79881	6657	5706						-					-	3329			
	3600					7592							0020									
200	900						8121								-			-	3802			
200	3001								6550							7056 i 7020 i			4939 4914			
	1800			:			04211							. (44141			
				=:		7827			5218													
	1800					7827	6709	5870		4696		_				5594	4895	4351	3916			
300	1800 - 3600 -				8338		6709	5870	8361	4696 7525		=		7832 6	5527	5594	4895 7840	4351 6969	3916 6272			
300	1800 - 3600 - 900 -					6948	6709 5 5956 5	5211	8361 4632	4696 7525 4169			8695	7832 6 6956 5	5797	5594i : 4969 i	4895 7840 4348	4351 6969 3864	3916 6272 3478			
300	1800 - 3600 - 900 - 1800 -					6948	5956 5 5556 4	5870 5211 4861	8361 4832 4321	4696 7525 4169 8889			8695	7832 6 6956 5 6482 5	797	4969 4830	4895 7840 4348 4051	4351 6969 3864 3601	3916 6272 3478 3241			
300	1800 - 3600 - 900 - 1800 - 3600 -				7778	69481 64821	5956 5 5556 4 8264 7	5211 4861 47231 6	8361 4832 4321 3428	4696 7525 4169 3889			8695 8103	7832 6 6956 5 6482 5	5797 5402 5585	5594 4969 4830 7359	4895 7840 4348 4051 6439	4351 6969 3864 3601 5723	3916 6272 3478 3241 5151			
300 400	1800 - 3600 - 900 - 1800 - 3600 - 900 -				7778 8078	6948 6482 6732	5956 5 5556 4	5211 4861 47231 6	8361 4632 4321 5428 4488	4696 7525 4169 3889 5785			8695 8103 8410	7832 6 6956 5 6482 5	5797 5402 5585 6607	4969 4830 7359 4806	4895 7840 4348 4051	4351 6969 3864 3601 5723 3738	3916 6272 3478 3241			

Table 2 (Cont). Hours of operation at various electrical rates and paybacks for totally enclosed, fan cooled, and explosion proof enclosure motors.

					At SO	07/kWI	1				1			A+ 50	08/kWi				
Horse		1				ick in Y	•				1				ck in Y				
Power	RPM	2	3	4	5	6	7	8	9	10	2	3	4	Fayba 5	6	7	8	9	40
10	1800		1	6833	5466					12733		7970		4782		3416			2391
	3600		7563	5673	4538	_	3241	-	2521			6630	4973	3978	3315	2841		2210	1989
20	1800	-	8730	6548	5238	4365	3741		1	2619		7620	5715	4572	3810	3266	2858	2540	2286
	3600		6833	5125	4100	3417	2929		_	2050		5987	4490	3592	2993	2566		1996	
40	1800		8553	6415	5132	4277	3666	3208	1			7503		4502	3752	3216	2814	2501	2251
	3600		6337	4753	3802	3168	2716	2378	2112		8325	5550	4163	3330	2775	2379	2081	1850	
50	1800		8670	6503	5202	4335	3716	-	_	_		7593	5695	4556	3797	3254	2848	2531	
	3600		6190	4643	3714	3095	2653	2321	2063	1857	8150	5433	4075	3260	2717	2329	2038	1811	
75	900						8436	7381	6561	5905				_	8600	7371	6450	5733	5160
	1800			7623	6098	5082	4356	3811	3388	3049			6658	5326	4438	3804	3329		
	3600			6723	5378	4482	3841	3361	2988	2689		7827	5870	4696	3913	3354	2935	2609	2348
100	1800			7140	5712	4760	4080	3570	3173	2856	_	8320	6240	4992	4160	35661	31201		
	3600		-	8148	6518	5432	4656	4074	3621	3259	_		7118	5694	4745	4067	3559	3163	
200	-			_	8128	6773	5806	5080	4516	4064				7114	5928	5081	44461	3952	
	1800	<u> </u>			8426	7022	6019	5266	4681	4213				7376	6147	5269	4610	4098	3688
	3600			8388	6710	5592	4793	4194	3728	3355			7335	5868	4890	4191	3668	32601	2934
300		_					7684	6724	5977	5379					7840	67201	5880	5227	4704
	1800		_	7448	5958	4965	4256	3724	3310	2979		8700	6525	5220	4350	3729	3263	29001	2610
	3600			6943	5554	4628	3967	3471	3086	2777		8087	6065	4852	4043	3466	3033	26961	2426
400	900				8830	7358	6307		4906	4415				7726	6438	55191	4829	4292	3863
	1800			7205	5764		4117		3202	2882		8410	6308	5048	4205	3604	3154	2803	2523
	3600			81031	6482		4630	4051	3601	3241			70951	4414	47301	4054	3548	3153	2838
Horse						9/kWh								At \$0.1					
	RPM	2	3	4	Paybac 5	k in Ye 6		_						Paybac	k in Ye	ars .			
															_	_			
			70671	53001	42401	_	7	8	9	10	2	3	4	5	6	7	8	9	10
20	136001		7067 5900	5300	4240 3540	3533	3029	2650	2356	2120		6373	4780	3824	3187	27311	2390	2124	1912
	1800		5900 i	4425	3540	3533 2950	3029 2529	2650 2213	2356 1967	2120 1770	7930	6373 5287	4780 3965	3824 3172	3187 2643	2731 2266	2390 1983	21241 17621	1912 1586
		7975	5900 i	4425 5083	3540 4 0 66	3533 2950 3388	3029 2529 2904	2650 2213 2541	2356 1967 2259	2120 1770 2033	7930	6373 5287 6103	4780 3965 4578	3824 3172 3662	3187 2643 3052	2731 2266 2616	2390 1983 2289	2124 1762 2034	1912 1586 1831
	1800	7975	5900 i	4425	3540 4066 3190	3533 2950 3388 2658	3029 2529 2904 2279	2650 2213 2541 1994	2356 1967 2259 1772	2120 1770 2033 1595		6373 5287 6103 4787	4780 3965 4578 3590	3824 3172 3662 2872	3187 2643 3052 2393	2731 2266 2616 2051	2390 1983 2289 1795	2124 1762 2034 1596	1912 1586 1831 1436
40	1800 3600	7975	5900 6777 5317 6657	4425 50831 3988	3540 4 0 66	3533 2950 3388 2658 3328	3029 2529 2904 2279 2853	2650 2213 2541 1994 2496	2356 1967 2259 1772 2219	2120 1770 2033 1595 1997	7930	6373 5287 6103 4787 5987	4780 3965 4578 3590 4490	3824 3172 3662 2872 3592	3187 2643 3052 2393 2993	2731 2266 2616 2051 2566	2390 1983 2289 1795 2245	2124 1762 2034 1596 1996	1912 1586 1831 1436 1796
40	1800 3600 1800		5900 6777 5317 6657	4425 5083 3988 4993	3540 4066 3190 3994	3533 2950 3388 2658 3328 2468	3029 2529 2904 2279 2853 2116	2650 2213 2541 1994 2496 1851	2356 1967 2259 1772 2219 1646	2120 1770 2033 1595 1997 1481	7930 7180 6655	6373 5287 6103 4787 5987 4437	4780 3965 4578 3590 4490 3328	3824 3172 3662 2872 3592 2662	3187 2643 3052 2393 2993 2218	2731 2266 2616 2051 2566 1901	2390 1983 2289 1795 2245 1664	2124 1762 2034 1596 1996 1479	1912 1586 1831 1436 1796 1331
40 50	1800 3600 1800 3600		5900 6777 5317 6657 4937 6747	4425 5083 3988 4993 3703 5060	3540 4066 3190 3994 2962 4048	3533 2950 3388 2658 3328 2468 3373	3029 2529 2904 2279 2853 2116 2891	2650 2213 2541 1994 2496 1851 2530	2356 1967 2259 1772 2219 1648 2249	2120 1770 2033 1595 1997 1481 2024	7930 7180 6655	6373 5287 6103 4787 5987 4437 6073	4780 3965 4578 3590 4490 3328 4555	3824 3172 3662 2872 3592 2662 3644	3187 2643 3052 2393 2993 2218 3037	2731 2266 2616 2051 2566 1901 2603	2390 1983 2289 1795 2245 1664 2278	2124 1762 2034 1596 1996 1479 2024	1912 1586 1831 1436 1796 1331 1822
40 50	1800 3600 1800 3600 1800	7405	5900 6777 5317 6657 4937 6747	4425 5083 3988 4993 3703 5060	3540 4066 3190 3994 2962 4048	3533 2950 3388 2658 3328 2468 3373 2410	3029 2529 2904 2279 2853 2116 2891 2066	2650 2213 2541 1994 2496 1851 2530 1808	2356 1967 2259 1772 2219 1648 2249 1807	2120 1770 2033 1595 1997 1481	7930 7180 6655	6373 5287 6103 4787 5987 4437 6073	4780 3965 4578 3590 4490 3328 4555 3263	3824 3172 3662 2872 3592 2862 3644 2610	3187 2643 3052 2393 2993 2218 3037 2175	2731 2266 2616 2051 2566 1901 2603 1864	2390 1983 2289 1795 2245 1664 2278 1631	2124 1762 2034 1596 1996 1479 2024 1450	1912 1586 1831 1436 1796 1331 1822 1305
40 50 75	1800 3600 1800 3600 1800 3600	7405	5900 6777 5317 6657 4937 6747 4820	4425 5083 3988 4993 3703 5060 3615	3540 4066 3190 3994 2962 4048	3533 2950 3388 2658 3328 2468 3373 2410 7650	3029 2529 2904 2279 2853 2116 2891	2650 2213 2541 1994 2496 1851 2530 1808 5738	2356 1967 2259 1772 2219 1648 2249 1607 5100	2120 1770 2033 1595 1997 1481 2024 1446 4590	7930 7180 6655 6525	6373 5287 6103 4787 5987 4437 6073 4350	4780 3965 4578 3590 4490 3328 4555 3263	3824 3172 3662 2872 3592 2862 3644 2610	3187 2643 3052 2393 2993 2218 3037 2175 6890	2731 2266 2616 2051 2566 1901 2603 1864 5906	2390 1983 2289 1795 2245 1664 2278 1631 5168	2124 1762 2034 1596 1996 1479 2024 1450 4593	1912 1586 1831 1436 1796 1331 1822 1305 4134
40 50 75	1800 3600 1800 3600 1800 3600 900	7405	5900 6777 5317 6657 4937 6747 4820 7883	4425 5083 3988 4993 3703 5060 3815 5913	3540 4066 3190 3994 2962 4048 2892	3533 2950 3388 2658 3328 2468 3373 2410 7650 3942	3029 2529 2904 2279 2853 2116 2891 2066 6557	2650 2213 2541 1994 2496 1851 2530 1808 5738 2956	2356 1967 2259 1772 2219 1846 2249 1807 5100 2628	2120 1770 2033 1595 1997 1481 2024 1446 4590 2365	7930 7180 6655	6373 5287 6103 4787 5987 4437 6073 4350 7097	4780 3965 4578 3590 4490 3328 4555 3263 5323	3824 3172 3662 2872 3592 2662 3644 2610 8268 4258	3187 2643 3052 2393 2993 2218 3037 2175 6890 3548	27311 2266 2616 2051 2566 1901 2603 1864 5906 3041	2390 1983 2289 1795 2245 1664 2278 1631 5168 2661	2124 1762 2034 1596 1996 1479 2024 1450 4593 2366	1912 1586 1831 1436 1796 1331 1822 1305 4134 2129
40 50 75	1800 3600 1800 3600 1800 3600 900 1800	7405	5900 6777 5317 6657 4937 6747 4820 7883 6980	4425 5083 3988 4993 3703 5060 3815 5913	3540 4066 3190 3994 2962 4048 2892 4730	3533 2950 3388 2658 3328 2468 3373 2410 7650 3942 3490	3029 2529 2904 2279 2853 2116 2891 2066 6557 3379	2650 2213 2541 1994 2496 1851 2530 1808 5738 2956 2618	2356 1967 2259 1772 2219 1648 2249 1607 5100 2628 2327	2120 1770 2033 1595 1997 1481 2024 1446 4590 2365	7930 7180 6655 6525	6373 5287 6103 4787 5987 4437 6073 4350 7097 6280	4780 3965 4578 3590 4490 3328 4555 3263 5323 4710	3824 3172 3662 2872 3592 2662 3644 2610 8268 4258 3768	3187 2643 3052 2393 2993 2218 3037 2175 6890 3548 3140	27311 2266 2616 2051 2566 1901 2603 1864 5906 3041 2691	2390 1983 2289 1795 2245 1664 2278 1631 5168 2661 2355	2124 1762 2034 1596 1996 1479 2024 1450 4593 2366	1912 1586 1831 1436 1796 1331 1822 1305 4134 2129 1884
40 50 75	1800 3600 1800 3600 1800 3600 900 1800 3600	7405	5900 6777 5317 6657 4937 6747 4820 7883 6980	4425 5083 3988 4993 3703 5060 3615 5913 5235	3540 4066 3190 3994 2962 4048 2892 4730 4188	3533 2950 3388 2658 3328 2468 3373 2410 7650 3942 3490 3708	3029 2529 2904 2279 2853 2116 2891 2066 6557 3379 2991	2650 2213 2541 1994 2496 1851 2530 1808 5738 2956 2618 2781	2356 1967 2259 1772 2219 1648 2249 1607 5100 2628 2327 2472	2120 1770 2033 1595 1997 1481 2024 1446 4590 2365 2094	7930 7180 6655 6525	6373 5287 6103 4787 5987 4437 6073 4350 7097 6280 6660	4780 3965 4578 3590 4490 3328 4555 3263 5323 4710 4995	3824 3172 3662 2872 3592 2662 3644 2610 8268 4258 3768 3996	3187 2643 3052 2393 2993 2218 3037 2175 6890 3548 3140 3330	2731 2266 2616 2051 2566 1901 2603 1864 5906 3041 2691 2854	2390 1983 2289 1795 1664 2278 1631 5168 2661 2355 2498	2124 1762 2034 1596 1996 1479 2024 1450 4593 2366 2093 2220	1912 1586 1831 1436 1796 1331 1822 1305 4134 2129 1884 1998
40 50 75 100 200	1800 3600 1800 3600 1800 3600 900 1800 3600 1800 900	7405	5900 6777 5317 6657 4937 6747 4820 7883 6980 7417	4425 50831 3988 49931 3703 5060 3615 5913 5235 5563	3540 4066 3190 3994 2962 4048 2892 4730 4188 4450	3533 2950 3388 2658 3328 2468 3373 2410 7650 3942 3490 3708 7368	3029 2529 2904 2279 2853 2116 2891 2066 6557 3379 2991 3179	2650 2213 2541 1994 2496 1851 2530 1808 5738 2956 2618 2781 5528	2356 1967 2259 1772 2219 1648 2249 1607 5100 2628 2327 2472 4912	2120 1770 2033 1595 1997 1481 2024 1446 4590 2365 2094 2225 4421	7930 7180 6655 6525	6373 5287 6103 4787 5987 4437 6073 4350 7097 6280 6680 7593	4780 3965 4578 3590 4490 3328 4555 3263 5323 4710 4995 5695	3824 3172 3662 2872 3592 2662 3644 2610 8268 4258 3768 3996 4556	3187 2643 3052 2393 2993 2218 3037 2175 6890 3548 3140 3330 3797	2731 2266 2616 2051 2566 1901 2603 1864 5906 3041 2691 2854 3254	2390 1983 2289 1795 2245 1664 2278 1631 5168 2661 2355 2498 2848	2124 1762 2034 1596 1996 1479 2024 1450 4593 2366 2093 2220 2531	1912 1586 1831 1436 1796 1331 1822 1305 4134 2129 1884
40 50 75 100 200	1800 3600 1800 3600 1800 3600 900 1800 3600 1800 900 1800	7405	59001 67771 53171 66571 49371 67471 48201 78831 69801 74171	4425 50831 3988 49931 3703 5060 3615 5913 5235 5563	3540 4066 3190 3994 2962 4048 2892 4730 4188 4450	3533 2950 3388 2658 3328 2468 3373 2410 7650 3942 3490 3708 7368 5272	3029 2529 2904 2279 2853 2116 2891 2066 6557 3379 2991 3179 6316	2650 2213 2541 1994 2496 1851 2530 1808 5738 2956 2618 2781 5528 3954	2356 1967 2259 1772 2219 1848 2249 1607 5100 2828 2327 2472 4912 3514	2120 1770 2033 1595 1897 1481 2024 1446 4590 2365 2094 2225 4421 3163	7930 7180 6655 6525	6373 5287 6103 4787 5987 4437 6073 4350 7097 6280 6660 7593	4780 3965 4578 3590 4490 3328 4555 3263 5323 4710 4995 5695 7118	3824 3172 3662 2872 3592 2862 3644 2610 8268 4258 3768 3996 4556 5694	3187 2643 3052 2393 2993 2218 3037 2175 6890 3548 3140 3330 3797 4745	2731 2266 2616 2051 2566 1901 2603 1864 5906 3041 2691 2854 3254	2390 1983 2289 1795 2245 1664 2278 1631 5168 22661 2355 2498 2848	2124 1762 2034 1596 1996 1479 2024 1450 4593 2366 2093 2220 2531 3163	1912 1586 1831 1436 1796 1331 1822 1305 4134 2129 1884 1998 2278
40 50 75 100 200	1800 3600 1800 3600 1800 3600 900 1800 3600 900 1800 3600 900 1800	7405	59001 67771 53171 66571 49371 67471 48201 78831 69801 74171	4425 5083 3988 4993 3703 5060 3815 5913 5235 5563 7908 8190 6525	3540 4066 3190 3994 2962 4048 2892 4730 4188 4450 6326 6552 5220	3533 2950 3388 2658 3328 2468 3373 2410 7650 3942 3490 3708 7368 5272 5460	3029 2529 2904 2279 2853 2116 2891 2066 6557 3379 2991 3179 6316 4519	2650 2213 2541 1994 2496 1851 2530 1808 5738 2956 2618 2781 5528 3954 4095	2356 1967 2259 1772 2219 1648 2249 1807 5100 2828 2327 2472 4912 3514 3640	2120 1770 2033 1595 1997 1481 2024 1446 4590 2365 2094 2225 4421 3163 3276	7930 7180 6655 6525	6373 5287 6103 4787 5987 4437 6073 4350 7097 6280 6680 7593	4780 3965 4578 3590 4490 3328 4555 3263 5323 4710 4995 5695 7118 7380	3824 3172 3662 2872 3592 2862 3644 2610 8268 4258 3768 3996 4556 5694	3187 2643 3052 2393 2993 2218 3037 2175 6890 3548 3140 3330 3797 4745 4920	2731 2266 2616 2051 2566 1901 2603 1864 5906 3041 2691 2854 3254 4067 4217	2390 1983 2289 1795 2245 1664 2278 1631 5168 2355 2498 2848 3559 3690	2124 1762 2034 1596 1996 1479 2024 1450 4593 2366 2220 2531 3163 3280	1912 1586 1831 1436 1796 1331 1822 1305 4134 2129 1884 1998 2278 2847
40 50 75 100 200	1800 3600 1800 3600 1800 3600 900 1800 3600 900 1800 3600 900 1800 900	7405	59001 67771 53171 66571 49371 67471 48201 78831 69801 74171	4425 5083 3988 4993 3703 5060 3815 5913 5235 5563 7908 8190 6525	3540 4066 3190 3994 2962 4048 2892 4730 4188 4450 6326 6552 5220	3533 2950 3388 2658 3328 2468 3373 2410 7650 3942 3490 3708 7368 5272 5460 4350	3029 2529 2904 2279 2853 2116 2891 2066 6557 3379 2991 3179 6316 4519	2650 2213 2541 1994 2496 1851 2530 1808 5738 2956 2618 2781 5528 3954 4095 3263	2356 1967 2259 1772 2219 1848 2249 1807 5100 2828 2327 2472 4912 3514 3640 2900	2120 1770 2033 1595 1997 1481 2024 1446 4590 2365 2094 2225 4421 3163 3276 2610	7930 7180 6655 6525	6373 5287 6103 4787 5987 4437 6073 4350 7097 6280 6680 7593	4780 3965 4578 3590 4490 3328 4555 3263 4710 4995 5695 7118 7380 5870	3824 3172 3662 2872 3592 2862 3644 2610 8268 4258 3768 3996 4556 5694 5904	3187 2643 3052 2393 2993 2218 3037 2175 6890 3548 3140 3330 3797 4745 4920 3913	2731 2266 2051 2566 1901 2603 1864 5906 3041 2691 2854 4067 4217 3354	2390 1983 1795 1795 1795 1664 2278 1631 5168 2355 2498 2848 3559 3690 2935	2124 1762 2034 1596 1996 1479 2024 1450 4593 2366 2093 2220 2531 3163 3280 2609	1912 1586 1831 1436 1796 1331 1822 1305 4134 2129 1884 1998 2278 2847 2952
40 50 75 100 200	1800 3600 1800 3600 1800 3600 900 1800 3600 900 1800 3600 900 1800 900 1800	7405	59001 6777 5317 6657 4937 6747 48201 7883 6980 7417 87001	4425 5083 3988 4993 3703 5060 3615 5913 5235 5583 7908 8190 6525	3540 4066 3190 3994 2962 4048 2892 4730 4188 4450 6326 6552 5220 8356	3533 2950 3388 2658 3328 2468 3373 2410 7650 3942 3708 7368 5272 5460 4350 6963	3029 2529 2904 2279 2853 2116 2891 2066 6557 3379 2991 3179 6316 4519 4680 3729	2650 2213 2541 1994 2496 1851 2530 1808 5738 2956 2618 2781 5528 3954 4095 3263	2356 1967 2259 1772 2219 1648 2249 1807 5100 2828 2327 2472 4912 3514 3640 2900 4842	2120 1770 2033 1595 1997 1481 2024 1446 4590 2365 2094 2225 4421 3163 3276 2610 4178	79301	6373 5287 6103 4787 5987 4437 6073 4350 7097 6280 6680 7593	4780 3965 4578 3590 4490 3328 4555 3263 4710 4995 5695 7118 7380 5870	3824 3172 3662 2872 3592 2662 3644 2610 8268 4258 3768 3996 4556 5694 5904 4896 7534	3187 2643 3052 2393 2993 2218 3037 2175 6890 3548 3140 3330 3797 4745 4920 3913	2731 2266 2051 2566 1901 2603 1864 5906 3041 2691 2854 4067 4217 3354 5381	2390 1983 2289 1795 2245 1664 2278 1631 5168 2661 2355 2498 2848 3559 3690 2935 4709	2124 1762 2034 1596 1996 1479 2024 1450 4593 2366 2093 2220 2531 3163 3280 2609 4186	1912 1586 1831 1436 1796 1331 1822 1305 4134 2129 1884 1998 2278 2847 2952 2348
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If you feel you have a feasible project after reviewing the data in Tables 1 and 2, please contact your EFD or NFESC. These agencies will assist you in validating your project and preparing the ECIP/ECAP documentation.

If you have any questions about efficient motors, please contact:

Gene Crank, Code ESC22, NFESC (805) 982-5589 or DSN 551-5589